National Institute of Environmental Health Sciences

Bayesian spatial quantile regression

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Abstract:

Tropospheric ozone is one of the six criteria pollutants regulated by the United States Environmental Protection Agency under the Clean Air Act and has been linked with several adverse health effects, including mortality. Due to the strong dependence on weather conditions, ozone may be sensitive to climate change and there is great interest in studying the potential effect of climate change on ozone, and how this change may affect public health. In this paper we develop a Bayesian spatial model to predict ozone under different meteorological conditions, and use this model to study spatial and temporal trends and to forecast ozone concentrations under different climate scenarios. We develop a spatial quantile regression model that does not assume normality and allows the covariates to affect the entire conditional distribution, rather than just the mean. The conditional distribution is allowed to vary from site-to-site and is smoothed with a spatial prior. For extremely large datasets our model is computationally infeasible, and we develop an approximate method. We apply the approximate version of our model to summer ozone from 1997-2005 in the Eastem U.S., and use deterministic climate models to project ozone under future climate conditions. Our analysis suggests that holding all other factors fixed, an increase in daily average temperature will lead to the largest increase in ozone in the Industrial Midwest and Northeast.

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Resource Description

Climate Scenario :

specification of climate scenario (set of assumptions about future states related to climate)

Other Climate Scenario

Other Climate Scenario: CM2.1 A2 scenario

Exposure :

weather or climate related pathway by which climate change affects health

Air Pollution, Meteorological Factors, Temperature

Air Pollution: Ozone

Temperature: Fluctuations

Geographic Feature:

resource focuses on specific type of geography

None or Unspecified

Geographic Location: ☑

resource focuses on specific location

United States

Health Impact: ☑

specification of health effect or disease related to climate change exposure

Health Outcome Unspecified

Model/Methodology: ☑

type of model used or methodology development is a focus of resource

Exposure Change Prediction, Methodology

Resource Type: ☑

format or standard characteristic of resource

Research Article, Research Article

Timescale: ☑

time period studied

Long-Term (>50 years)